

REMARKS/ARGUMENTS

Claims 1-3, 5-7 and 9-12 are rejected under 35 U.S.C 103(a) as being unpatentable over Kubo et al. (4,901,531) in view of Hori et al. (5,761,921). Claims 4, 8, 13-14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kubo et al. in view of Hori et al. and Jenkins (5,056,315). In response, the applicants have reviewed the cited references in detail and believe that the claims are patentably distinctive thereover for the reasons to be discussed hereinbelow.

Kubo et al. shows a diesel engine which uses one of its six cylinders as a power recovery device. Waste heat is derived from the oil cooler and the cylinder head by way of a reciprocal expander 235. Rather than using an organic working fluid, the Kubo et al. reference uses steam.

The Hori et al. reference shows an air conditioning system in which the compressor is driven by rotating power generated by a rankine cycle expander. The working medium is an organic working fluid that is used in both the rankine cycle and the refrigeration cycle. The expander 3 and the compressor 5 are housed in the same sealing case 85 so that the driving force from the expander 3 can be applied to directly drive the compressor 5. The manner in which this is accomplished is not disclosed. However, the Hori et al. reference clearly does not show or suggest the use of a turbine for that purpose.

The Jenkins reference shows a Wankel rotary engine which uses its exhaust gases to drive a turbine expander 54, which in turn drives a generator 34. Thus, only a single heat source from the engine is used to drive the turbine 54. The heat from the exhaust gases at the outlet end of the turbine pass through a heat exchanger 58 to warm the hot water 70 in a reservoir. A heat exchanger 60 takes heat from the lubricant 59 and passes it to the water 70 and a heat exchanger 64 removes heat from the engine coolant 62 and passes it to the water 70 in the reservoir. The hot water 70 is then simply used as a source of hot water.

In his rejection of claims 1-3, 5-7, 9-12 over Kubo et al. in view of Hori et al. the Examiner says that Kubo et al. does not disclose the organic working fluid but goes on to say that "It would have been obvious at the time the invention was made

to a person having ordinary skill in the art to use organic fluid as the working fluid or refrigerant in Kubo et al. as taught by Hori et al. for the purpose of achieving appropriate work output". The applicants strongly disagree.

Firstly, there is no motivation to combine the reference of Kubo et al. with the Hori et al. reference. Kubo et al. is silent with respect to the use of organic working fluid. The Hori et al. reference does not teach or remotely suggest the use of organic working fluid in a cylinder piston expansion device, especially not the cylinder of a multi cylinder internal combustion engine in order to transfer thermal energy to motive power.

Secondly, the use of the organic working fluid in the apparatus of the Kubo et al. reference does not seem to be possible since the organic working fluid would most likely fail if incorporated into the high temperature ICE system of Kubo et al. The fluid would most likely decompose, especially the oils (POE) in the working fluid. If the organic working fluid were employed in the piston/cylinder of the ice, the fluid would most likely leak past the seals and contaminate the lubrication system and the like.

Further distinguishing features of claims 1 and 9 is the recitation of a turbine which is neither shown nor suggested by either of the Kubo et al. or the Hori et al. reference taken individually or in combination. Not only does Kubo et al. not show or suggest the use of a turbine, it teaches away from steam turbines (see column 1, lines 47 and 48, and column 3, lines 39-43). Clearly, the piston and cylinder of an internal combustion engine of the Kubo et al. reference, or the expander 3 of the Hori et al. reference cannot reasonably be considered to be equivalent to a turbine as specifically claimed by the applicants in independent claims 1 and 9.

The Jenkins reference does not remedy the defects of the Kubo et al. or Hori et al. references. The Jenkins reference explicitly teaches the use of a turbine expander to rotate a turbine shaft along with gear trains to supplement the rotation of the Wankel engine in driving a generator 34. The heat exchanger 70 cited by the Examiner uses water in a common reservoir of liquid (see Jenkins at column 7, lines 45-60). Moreover the Jenkins reference explicitly teaches the lubricant 59 leaves the

engine and exchanges heat to water in the heat exchanger 60, thus, a separate working fluid loop requiring separate equipment (see Jenkins at column 7, lines 19-29). Kubo et al. teaches against such separate loops. The Kubo et al. reference teaches away from the Jenkins reference because the Kubo et al. explicitly denounces the use of external additional components such as turbines and reduction gear trains to supplement the basic engine output. This is contrary to the teaching of Jenkins. Thus, there is no motivation to combine Jenkins with the references of Kubo et al. and Hori et al.

Referring further to claim 1, there is recited a single heat exchanger that is adapted to transfer heat from a plurality of sources within said engine. On the contrary, the Kubo et al. reference shows separate heat exchangers for transferring heat from the oil and the cylinder head, and there is no suggestion for combining these functions in a single heat exchanger. Similarly, the Jenkins reference shows separate heat exchangers 58, 60 and 64 for exchanging heat with the exhaust gases, lubricant and engine coolant, respectively. Accordingly, not only is this a substantial structural difference from the prior art, it also offers a substantial savings by combining the function of multiple components.

Claims 2-8 recite further features of the structure and/or function of the single heat exchanger, none of which are shown or suggested by any of the references taken individually or in combination.

In addition to the distinguishing features of claim 9 reciting the organic motive fluid and the turbine, the dependent claims thereon recite further distinguishing features. Claim 12 recites a step of circulating an engine coolant and an engine lubricant through a single heat exchanger, which is unobvious over the cited art for the reasons discussed hereinabove.

Claim 13 recites the further feature of the engine coolant and the engine lubricant being made to flow through the single heat exchanger in the same direction, a feature which is not shown or suggested by any of the cited references.

For the reasons discussed hereinabove, the applicants believe that the claims, as amended, are patentably distinctive over the cited references. A reconsideration

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of the Examiner's rejections and a passing of the case to issue is therefore respectfully requested.

If the Examiner wishes to expedite disposition of the above-captioned patent application, he is invited to contact Applicant's representative at the telephone number below.

The Commissioner is hereby authorized to charge any additional fees associated with this communication or credit any overpayment to Deposit Account No. 50-0289.

Respectfully submitted,

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